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## THE SEXUAL ELEMENTS OF THE GIANT SALAMANDER, *CRYPTOBRANCHUS ALLEGHENIENSIS*.

ALBERT M. REESE.

In the spring and early summer of 1902, the author made strenuous efforts to obtain embryological material for investigating the development of the hellbender (*Cryptobranchus Allegheniensis*). These unsuccessful efforts have been described in an article entitled "The Habits of the Giant Salamander."<sup>1</sup>

In the fall of 1903, another effort was made to obtain the desired material, and a dozen or more live hellbenders were obtained as the result of a trip to the region of the Allegheny River, in western Pennsylvania.

These animals were all about the same size, 45 cm. in length, and were sent by express from their native stream to Syracuse, N. Y.

Upon opening the box, in which they were shipped, after its arrival in Syracuse, a number of eggs were found scattered through the grass that had been placed there to protect the animals during their trip. There seemed to be no difference in the coloration of the males and females, and the only way in which they could be distinguished was by the fact that, in the males, the lips of the cloaca were considerably swollen by the enlargement of an elongated mass of glandular tissue on each side.

In handling one of the ripe females of this lot of hellbenders, the author was bitten on the thumb; this was the only time in which any attempt to bite had been noticed, though many dozen animals had been handled at many different times. The bite was not at all serious, being merely a painful pinch which scarcely broke the skin. In removing one of the females from the box in which they had arrived, an egg, enclosed in its jelly-like envelope, was seen protruding from the cloaca. By gently pulling this extruded egg, it was found that a whole string of eggs could be drawn from the cloaca, without apparently injuring them in the least.

<sup>1</sup> *Popular Science Monthly*, May, 1903.

Each egg is a spherical yellow body, about 6 mm. in diameter, resembling somewhat the yolk of a miniature hen's egg. It is surrounded by a clear gelatinous envelope, which is arranged in two distinct layers (Fig. 1).

When removed from the gelatinous envelopes, as may easily be done by cutting through the latter with a pair of fine scissors, the egg is seen to be enclosed in a very thin and delicate vitelline membrane which is easily torn in handling.

The yolk, which is apparently evenly distributed throughout the egg, is made up of a compact mass of granules of various sizes (Fig. 2).

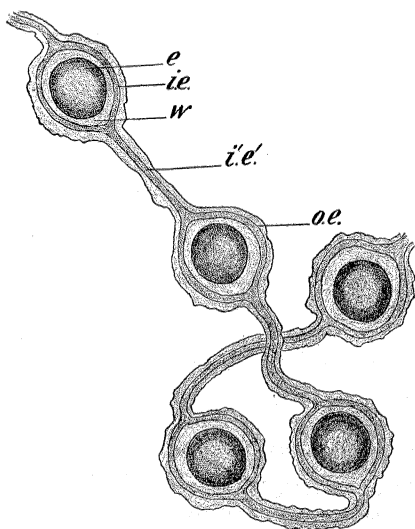


FIG. 1.

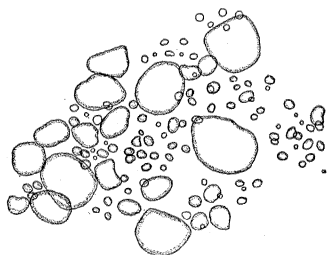


FIG. 2.

The egg is surrounded by a small amount of watery material (Fig. 1, *w*) which is, in turn, enclosed in a capsule of more dense jelly, the inner envelope (Fig. 1, *i. e.*). The inner envelope is continued as a solid, more or less tough cord of jelly (*i'. e'.*) from egg to egg, and binds them together in the continuous strings that have already been mentioned. The distance between two adjacent eggs of the string is usually about four or five times the diameter of the egg, but the elasticity of the jelly will, of course, permit the eggs to be drawn much further apart.

The outline of the inner envelope is sharp and even, while that of the outer envelope (Fig. 1, *o. e.*) is more or less irregular and uneven. The outer envelope is composed of such transparent jelly that it might easily be overlooked at the first glance. It forms a continuous layer over the entire mass of eggs.

When the unfertilized eggs are left for some days in water, they become very much swollen, by the osmosis of water through the vitelline membrane, and may eventually burst.

There was no apparent swelling of the gelatinous envelopes on coming in contact with water as is described in connection with some other amphibian eggs.

Several dozen eggs were obtained from one average-sized female, about two dozen being drawn, without apparent injury, from the cloaca, while the rest were obtained only after killing the animal and opening the body cavity. All the eggs obtained in the latter way were found to be contained in the right oviduct, the ova of the left ovary being nearly all in a very immature condition. Whether or not this was a normal condition, indicating perhaps, a very prolonged breeding season, it was not possible to say.

The spermatozoa were obtained as a milky fluid from the living males by the usual process of stripping, though

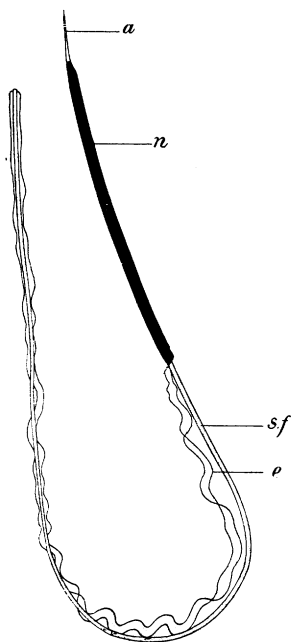


FIG. 3.

considerable pressure had, in most cases, to be exerted. They were immediately examined under the higher powers of the microscope, but no motion could be detected, though it would naturally be expected that spermatozoa obtained in this way would show the usual activity of mature spermatozoa.

An attempt was made to artificially fertilize the eggs by putting them into a dish of water into which a great number of spermatozoa had been stirred, but the attempt was entirely unsuccessful.

No structures resembling spermatophores were discovered, and there was nothing that would seem to give any indication of the method by which the act of fertilization was accomplished.

A single spermatozoön, as seen under a magnification of about 1,300 diameters, is shown in Fig. 3.

Fairly good preparations were easily made by drying them rapidly on the slide, and staining in hæmatoxylin and eosin.

The nucleus, *n*, is very much elongated, so that it makes up almost one third of the entire length of the spermatozoön. It is capped, at its anterior end, by a sharp, gradually-tapering apical body, *a*, which is plainly differentiated from the nucleus proper by the fact that it does not take up the stain to any great extent. No structural details in the nucleus or apical body can be discerned with the magnification used, nor is any middle-piece distinguishable. The tail, which is comparatively stout, consists of a central supporting fiber, *s. f.*, which takes up the stain slightly, surrounded by a transparent envelope, *e*, which does not stain at all. The envelope is usually considerably wrinkled and twisted, probably by the rough method of fixation.

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